

**PROJECT SURVEY**  
**FOR**  
**FORTIS WIND ENERGY**  
**WIND TURBINES**



**PROJECT NAME:**



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## 1. PREFACE

This document is meant to provide FORTIS with detailed information of the (local) circumstances for a specific project with FORTIS wind turbines.

Each section has to be filled in as detailed as possible in order to determine the configuration of the turbine.

We tried to cover every aspect needed for the installation and future operation of your wind turbines. Please let us know if you think items are missing.

**PLEASE FILL IN THE GREY FIELDS.**  
**BY MULTIPLE CHOICE QUESTIONS PLEASE PUT "X" WHERE APPLICABLE**



## 2. GENERAL INFORMATION

DATE OF SURVEY

SYSTEM PARTNER

Address

Postal code

Town

Country

Telephone

Telephone cellular

Fax

E-mail address

CUSTOMER NAME

Project contact person

Address

Postal code

Town

Country

Telephone

Telephone cellular

Fax

E-mail address

SITE NAME

Address

Postal code

Town

Country



### 3. TURBINE INFORMATION

#### TURBINE TYPE

- |   |  |
|---|--|
| <input type="checkbox"/> Passaat 1.4 kW | <input type="checkbox"/> Alize 10 kW         |
| <input type="checkbox"/> Montana 5 kW   | <input type="checkbox"/> Grid Connected      |
| <input type="checkbox"/> Stand alone    | <input type="checkbox"/> Hybrid (PV modules) |

#### TOWER TYPE: FREE STANDING OR GUYED

- |       |   |   |
|-------|---|---|
| Tower | <input type="checkbox"/> 12 meter tubular | <input type="checkbox"/> 12 meter guyed |
|       | <input type="checkbox"/> 15 meter tubular | <input type="checkbox"/> 15 meter guyed |
|       | <input type="checkbox"/> 18 meter tubular | <input type="checkbox"/> 18 meter guyed |
|       | <input type="checkbox"/> 24 meter tubular | <input type="checkbox"/> 24 meter guyed |
|       | <input type="checkbox"/>                  | <input type="checkbox"/> 30 meter guyed |

#### NUMBER OF TURBINES

- #  Hybrid (PV modules)

#### TO BE SUPPLIED BY FORTIS

- |   |   |
|---|---|
| <input type="checkbox"/> Turbine            | <input type="checkbox"/> Tower                    |
| <input type="checkbox"/> Foundation anchors | <input type="checkbox"/> Wind Measurement sensors |
| <input type="checkbox"/> Controlling        | <input type="checkbox"/>                          |
| <input type="checkbox"/> Other (specify)    | <input type="checkbox"/>                          |



## 4. SITE

Provide a detailed map(s) of the site with the North direction and the following locations:

- turbine
- location for controlling / dump load
- transport route to site
- prevailing wind direction
- 

Attach photos of turbine location in all wind directions

done

What is terrain roughness (see Appendix 1)

What are the coordinates of the location

Latitude (North/South)

Longitude (East/West)

Describe ease of accessibility by truck and crane of site

What is name of nearest international sea port

What is name of nearest international air port

Is the site critical for noise

yes  no

What is distance to nearest neighboring house

Are permit problems to be expected

yes  no

Has the foundation been designed by a certified civil engineer, based on the foundation loads provided by Fortis?

yes  no

Consult with the crane company

done

Gin pole and winch applicable

yes  no

Distance to the turbine (m)



## 5. CLIMATE AND WIND

Average wind speed (year, month, day) (m/s)

Wind measured at height of (m)

Is there detailed wind data available?

Wind measured (attach report)

 yes  no

Wind calculated (Virtual Met Mast - attach report)

 yes  no

Turbulence intensity (%)

  


Hurricanes / seasonal storms

 yes  no

Earthquakes

 yes  no

Lightning often

 yes  no

What is local temperature range and maximum humidity

Minimum (°C)

Maximum (°C)

Max. humidity (%)

## 6. BATTERY BANK

Backup system

 yes  no

Totally stand alone system (autonomous)

 yes  No

Battery type: Deep cycle VLRA\*

\* VRLA = Valve Regulated Lead Acid

 yes  no

Battery voltage 48V

 yes  no

Days of Autonomy (1-10) days

Demand in kWh/yr

Special requirements for the battery Bank



## 7. GRID CONNECTION

Grid frequency & max. tolerances

Hz +  % -  %

Grid voltage at connection point

V +  % -  %

Have grid measurements been made?

yes  no

3-phase grid

yes  no

Number of grid failures (power cuts) / year

## 8. WIND-DIESEL HYBRID

FOR EACH DIESEL GENERATOR:

Manufacturer

Year of production

Name plate capacity

Current capacity

Diesel consumption  
(liter/kWh)

Diesel Control system

Mechanical  Electronic

Type of speed control

Droop  Fixed frequency

Storage of excess electricity

No  Batteries

Water  Ice

Other, specify

Shutting off certain load (temporarily) possible

yes  no





## 9. GROUNDING

Is grounding system according to minimal Fortis requirements  yes  no

(The grounding for lightning protection of the tower, and the safety ground for the control cabinet must not be interconnected)

## 10. CONTROL ROOM AND CONTROL CABINET

Control room for control cabinet  Available  Not available

Actual size (l x w x h)

Is the control room located in a dusty environment  yes  no

Is ventilation sufficient and rain proof  yes  no

Work light in the control room  yes  no

## 11. TURBINE CABLES

Cable length for Fortis wind turbine to reach the controlling cabinet.

a) from nacelle to bottom tower (m)

b) from bottom tower base to controlling (m)

c)

d)

## 12. CABLE GUIDE

If needed, refer to the Cable Guide on Fortis Manuals for an indication of the minimal conductor sizing. Confirm the conductor size with your cable supplier.

Cable from control cabinet to grid connection (meters) and conductor size (mm<sup>2</sup>)



### 13. REMOTE MONITORING

Type of connection

- GSM/GPRS (EU) (mobile phone)
- TCP/IP (network/internet)
- Otherwise
- 

### 14. DELIVERY TIME

When is the grid connection in place? (dd/mm/yyyy)

When is the internet connection in place  
(dd/mm/yyyy)

When is the requested date of installation  
(dd/mm/yyyy)

### 15. REMARKS

## 16. APPENDIX 1

### Terrain Roughness

High above ground level, at a height of about 1 kilometer, the wind is hardly influenced by the surface of the earth at all. In the lower layers of the atmosphere, however, wind speeds are affected by the friction against the surface of the earth. In the wind industry one distinguishes between the roughness of the terrain, the influence from obstacles, and the influence from the terrain contours, which is also called the orography of the area.

In general, the more pronounced the roughness of the earth's surface, the more the wind will be slowed down. Forests and large cities obviously slow the wind down considerably, while concrete runways in airports will only slow the wind down a little. Water surfaces are even smoother than concrete runways, and will have even less influence on the wind, while long grass and shrubs and bushes will slow the wind down considerably

### Roughness Classes and Roughness Lengths

In the wind industry, people usually refer to roughness classes or roughness lengths, when they evaluate wind conditions in a landscape. A high roughness class of 3 to 4 refers to landscapes with many trees and buildings, while a sea surface is in roughness class 0.

Concrete runways in airports are in roughness class 0.5. The same applies to the flat, open landscape to the left which has been grazed by sheep.

The proper definition of roughness classes and roughness lengths may be found in the table below. The term roughness length is really the distance above ground level where the wind speed theoretically should be zero.

For further information on turbine siting, visit the Danish Wind Industry Association at

<http://www.vindselskab.dk/en/tour.htm>

### Roughness Classes and Roughness Length Table

Roughness Class	Roughness Length (m)	Energy Index (%)	Landscape Type
0	0.0002	100	Water surface
0.5	0.0024	73	Completely open terrain with a smooth surface, e.g. concrete runways in airports, mowed grass, etc.
1	0.03	52	Open agricultural area without fences and hedgerows and very scattered buildings. Only softly rounded hills
1.5	0.055	45	Agricultural land with some houses and 8 meter tall sheltering hedgerows with a distance of approx. 1250 metres
2	0.1	39	Agricultural land with some houses and 8 meter tall sheltering hedgerows with a distance of approx. 500 metres
2.5	0.2	31	Agricultural land with many houses, shrubs and plants, or 8 meter tall sheltering hedgerows with a distance of approx. 250 metres
3	0.4	24	Villages, small towns, agricultural land with many or tall sheltering hedgerows, forests and very rough and uneven terrain
3.5	0.8	18	Larger cities with tall buildings
4	1.6	13	Very large cities with tall buildings and skyscrapers